



LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

Power Balance Performance on the National Ignition Facility

K. LaFortune, C. Widmayer, C. Haynam, D.
Kalantar, P. Wegner, M. Bowers, S. Dixit

April 15, 2009

Inertial Fusion Sciences and Applications
San Francisco, CA, United States
September 6, 2009 through September 11, 2009

Disclaimer

This document was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor Lawrence Livermore National Security, LLC, nor any of their employees makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or Lawrence Livermore National Security, LLC. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or Lawrence Livermore National Security, LLC, and shall not be used for advertising or product endorsement purposes.

Power Balance Performance on the National Ignition Facility

K. LaFortune, C. Widmayer, C. Haynam, M. Shaw, D. Kalantar, M. Bowers, P. Wegner,
S. Dixit, S. Haan, D. Munro, G. Erbert, M. Hermann, B. Beeman, T. Weiland

Lawrence Livermore National Laboratory, Livermore CA 94550
lafortune1@llnl.gov

*Abstract submitted to The Sixth International Conference on
Inertial Fusion Sciences and Applications, September 6 – 11, 2009*

Recent experiments on the National Ignition Facility (NIF) have demonstrated the facility's power balance capability. Power balance is a measure of the temporal uniformity among multiple beams or beam groups in a multi-beamline laser. Users of the NIF facility will need precise control of the laser for a wide range of experiments. For example, in indirect drive Inertial Confinement Fusion (ICF) experiments, the NIF laser beams will be delivered onto the interior surface of a hohlraum, generating x-rays. In order for the x-rays emitted to be sufficiently uniform to symmetrically compress the spherical ignition capsule at the center of the hohlraum, each beamline needs to precisely deliver the requested temporal power profile to its intended target. The achieved power balance precision is determined by both the accuracy of the pulse shaping hardware and the repeatability of the energetics of the laser. The precision that is required for ICF targets is a function of time and power level during the pulse. We have developed a model that predicts the time-dependent power balance performance of an arbitrary pulse shape. In this model, performance is determined by a handful of dominant terms, whose magnitude we have characterized. The model and the power balance requirements for the current National Ignition Campaign (NIC) as well as the most recent demonstrated performance on 96-beam and full 192-beam NIF shots will be discussed.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344.